

Measurement and Verification Report

Fill in this template to provide a complete account of the M&V methods used in your project. In addition to completing the indicated fields, please also provide a process and instrumentation diagram of the technology's installation, or a simplified block diagram.

Project Title: Donna Project Plan: Electrochromic Window Demonstration

Investigators: Eleanor Lee

Investigator Organization: GSA Green Proving Ground

Technology Name: Electrochromic Windows

Brief Description of Technology:

Electrochromic (EC) windows tint reversibly with a small applied voltage, enabling active control of solar heat gains as well as providing daylight management and glare control. They are now becoming available at sizes suitable for commercial building applications. Previous work has showed this technology to have the potential for significant energy savings and visual comfort improvements. In particular, there is evidence that suggests that improved visual comfort results in shorter periods during which it is necessary to deploy operable shading (e.g. blinds), that occlude the view of the exterior. Improved daylight management and elimination of blinds are key levers needed to deliver the energy benefits and cost effectiveness for this technology.

Electrochromic windows have shown potential to reduce visual discomfort without occluding the view of the exterior, they are a candidate for improving the operational effectiveness of border facilities (or any other facilities in which maintaining visual contact must be balanced by the need to control glare) through decreasing the amount of time during which operable shading prevents direct visual contact with the exterior. This evaluation, therefore, will provide an 'acid test' of a core component of the functionality of electrochromic technology, ability to maintain visual comfort and preserve views to the outside without recourse to operable shading devices such as blinds.

Location Information

Building Name: Donna Land Port of Entry

Address and City: Donna, TX

Description of Building:

The General Services Administration (GSA) owns land port of entry facilities that monitor traffic through the land borders of the United States. In this type of facility it is important for building occupants to maintain direct visual contact with the exterior surroundings. However, the windows that allow this visual contact also can allow a direct view of the sun's orb, often resulting in deployment of operable shading devices. Operable shading devices address the visual discomfort from direct visibility of the sun, but also occlude the view of the exterior, interfering with the mission of the occupants and posing a possible security hazard.

The Donna Land Port of Entry is a border inspection station located at the border between the United States and Mexico near Donna, Texas. The study will take place in two areas of the facility: the command center and one of the inspection booths for vehicular traffic into the United States. The command center is the room from which Customs and Border Protection (CBP) activity on the Donna LPOE is overseen. Windows face East, West and South, with vehicular traffic coming from the south past the inspection booths and into an inspection area. Inspection booths and inspection area are shaded by a large canopy. At night, the inspection area is lighted by luminaires mounted on the underside of the canopy. Horizontal illuminance is approximately 300-400 lx. The facility grounds, as well as other buildings in the facility are visible towards the West and East. The inspection booths are located to the south of the inspection area. Booth doors face East. Booths are glazed on all four elevations. The south elevation faces the road that accesses the Port of Entry. In sunny conditions, the solar disk is visible during a substantial part of the day. During normal booth operation the occupants of the inspection booths spend a substantial amount of time inspecting incoming vehicles. As a result, booth doors are usually open.

Building size: [Click here to enter text.](#)

Climate zone: [Click here to enter text.](#)

Building owner: General Services Administration

Building operation hours: [Click here to enter text.](#)

Documentation of the building's base year condition: [Click here to enter text.](#)

Any significant equipment problems: [Click here to enter text.](#)

Technology Objectives, Metrics and Potential Issues

Objective	Metrics	Equipment	Potential issues
Occupant perception	Occupant responses to online surveys	Online surveys distributed to on-site personnel.	Number and quality of survey responses. The number of survey responses is likely to be below the threshold that establishing highly significant statistical correlations would require.
Visibility	<ul style="list-style-type: none"> • Time-lapse luminance maps of visual field of typical occupant • Exterior vertical illuminance or irradiance. • Exterior global horizontal illuminance or irradiance. 	<p>Building Automation System (BAS) data for duration of the study</p> <p>HDR (high-dynamic-range) camera</p> <p>Light meter to be used on two field visits</p>	<p>Weather. Field measurements require clear sky. During certain periods of the year, it may be hard to plan for the field trips because of uncertainty with weather.</p> <p>Annual variability of visual conditions. Variations in solar position, atmospheric conditions, or any other factor that varies throughout the year could reduce the comparability of pre- and post-installation measurements and survey responses. Measurements of vertical irradiance or illuminance will be taken in an attempt to control for this factor.</p>

M&V Instrument List

- *Online surveys provided to on-site staff before and after installation of electrochromic windows.*
- *HDR Camera (No specific model or price listed)*
- *Light meter (No specific model or price listed)*

Cost of Installing M&V Verification

Total cost of instruments and ancillary equipment: [Click here to enter text.](#)

Total cost of labor: [Click here to enter text.](#)

Labor skill sets used (Electrician, HVAC technician, etc.):

- [Click here to enter text.](#)
- [Click here to enter text.](#)
- [Click here to enter text.](#)

Name and contact information of contractors used for installation:

[Click here to enter text.](#)

Data Transmission and Analysis

Method used to transmit data from demonstration site to the lab (select all that apply):

☒ Data files manually downloaded from loggers and emailed to lab

Period of data file download and transmission (Weekly, monthly, etc.): Two site visits over study period

☐ Automated transmission of data

Transmitted via: ☐ Cellular modem ☐ Other: [Click here to enter text.](#)

☐ Other: [Click here to enter text.](#)

Special issues with transmission:

None listed.

Format in which data was transmitted to lab (.csv, .xlsx, etc.): Not specified

Software used to analyze data: Not specified

Methods used to analyze data:

None specified

Methods used to present data:

None specified

Other Comments

No comments.